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SPACE STATIONS: LIVING IN ZERO GRAVITY;
DEVELOPMENTAL TASK FOR PSYCHOLOGISTS AND
SPACE ENVIRONMENTAL EXPERTS

Eberhard Ludwig

Translation of: "Raumstationen: Wohnen in Schwerelosigkeit;
Entwicklungsaufgabe fuer Psychologen und Raumgestalter",
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16. Abstract The recent advances in the psychological aspects of space station design are discussed, including the impact of the increase in awareness of both the public in general as well as space environmental experts of the importance of psychological factors when designing space stations and training astronauts.			
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Commentary

Space Stations: Living in Zero Gravity

Developmental Task for Psychologists and Space Environmental Experts

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On May 12, 1983, a Soviet Soyuz spacecraft was launched for a manned space flight. Cosmonaut Lebedev kept a diary, from which excerpts of his notes were published in the Moscow edition of Pravda. These excerpts provide revealing insights into the psychological conditions of cosmonauts in the current stage of space flight. It appears that with increasing amounts of time spent in orbit, the initial euphoria subsides, while the desire to return home increases simultaneously. In the press, especially in the USA, the morale report has gained attention, and has added to the awareness that the laws of technology alone do not determine the layout of spacecraft; rather, the human psyche must be taken into consideration if mankind is to feel at home in space.

The first phase of the manned space station is to consist of laboratory and workstation operations, which the crew will

operate for a half-a-year, after which they would be relieved by a new crew of specialists. Similar to work on oil rigs, arctic observation stations, and other short-term posts on earth, the crew would be expected to live with uncomfortable and spartan conditions. Living conditions play only a subordinate role under such conditions. The individual must accept the short-term stressfull health conditions, and is subject to temporary psychic stress due to poor living conditions. Although there will be attempts to make the living conditions as pleasant as possible, the relaxation periods restfull, and to increase the value of the experience of living in an altered environment, nonetheless the psychological and environmental aspects will play a central role only in the later, second phase, which will be concerned with the conditions of actually living in space.

Technology is increasingly determining environmental conditions even here on Earth, even if many natural conditions still have an effect also. However, with the help of cutting-edge technological know-how, space experts are constructing an entirely artificial world in the middle of the cold, airless desert of space. They are being confronted with difficult, and sometimes unfamiliar conditions. They are as yet unable to use practical experience and proven methods to overcome the most frequently occurring phenomena, such as the lack of gravity, reduced air circulation and the stress on the sensory organs, such as

through excessive noise. Their task is to utilize the newest discoveries and test them experimentally. In fulfilling this task, psychological and space environmental aspects can not easily be separated from one another. When mankind expresses itself by constructing a building, the building is an external reflection of the human psyche. In turn, this then has a reverse effect on mankind, influencing especially his outlook on life. This means that all available kinds of technology and the arts must be utilized. A long-term process of increasing awareness and empirical examination will be necessary to determine the final design, fulfilling not only the technological purpose, but also taking into consideration the human psyche, and thus providing suitable conditions for the new tasks demanded of humanity.

If this problem is compared to the development of the automobile, the current space stations would resemble the early models of Gottfried Daimler from the year 1886, while we are facing a future project for the 21st century that goes beyond the concepts of today's technology to overcome the known difficulties, and effortlessly fulfills all imaginable requirements. If the development of the automobile required one hundred years, we are hoping to utilize our expanded knowledge and computer expertise to formulate a strategy to reduce this period of development to just a few years. I would like to elaborate on some of the

well-known applications as follows.

In the media, the external shape, or the entire concept of the spacecraft, plays the dominant role. At first, it becomes apparent that the designs of the Americans are markedly different from those of the Soviets. NASA has selected a building-block system, which can be limitlessly expanded and enlarged. However, the Soviet space planning authorities are following a different principle. They already have space stations of the Salyut series, which may be altered by docking connections along the axial plane. This extremely simple system is both the current design as well as a design for the future, which would encompass much larger dimensions. These designs represent the basic concepts of their respective economies and technologies; here, both are very open and variable, while there they are closed, centrally controlled systems with pre-determined boundaries. One can assume that the future trends will come closer to each other.

Observers here on Earth would first be impressed by the exterior shape, which is only natural, as they are the ones who would be paying for it, and they will have to be enticed to fund the operation using their fantasy through advertisement; the astronaut, however, will only rarely have a chance to see the entire station. For him, the inner structure, the divisions

among the various sections and the connecting passageways will be of greater importance. They represent the streets and plazas of a city out of history, where humans met and worked with one another without other means of transportation. A logical and carefully planned arrangement should ensure that the main living area is of a suitable nature. In no case should the final result be merely a result of technical necessity. We can assume that designs significantly different from what we might have expected will be the result. The social and esthetic concepts of human life up until now have been directly influenced by gravity. There was an up and a down; standing upright was a part of human dignity. The lack of gravity in near-Earth orbit, which is in actuality a state of permanent free-fall, does not result in any such type of orientation system. Even the time references are lacking, such as day and night and the seasons. Other common references, such as light and shade or heat and cold are only experienced in excess, and can only be used in filtered form, and may be totally replaced by technological means.

The current models are merely Earth structures placed into zero gravity; the American models are the same size as the dimensions of the Space Shuttle cargo bay, then built up either vertically or horizontally. The Soviet Salyut spacecraft, which may be more independent in its dimensions, is also designed with gravity in mind. However, it is usual to forego long-term planning, and

simply design a short-term auxiliary structure, such as the retractable landing gear of a modern airplane. It is possible and logical to design a station in a circular shape, with usable surface all around, as one does not need a surface to walk on; this would result in an area without hard-to-reach places, such as the ceiling of a room. The passageways should be similar, where one would not have to move in a two-dimensional direction, but rather where three-dimensional planning would be required. It would be necessary to replace the gravitational orientation system with another similar orientation system, which would provide a reference point for the entire structure.

Up until now, the sleeping quarters in spacecraft consisted of a kind of sleeping bag which was placed along a wall. In manned space stations, it is clearly evident from the required standards previously mentioned that each astronaut will have to have his own private area provided for him; it will have to be arranged according to psychological criteria. Living quarters will be characterized by warmer colors and more natural surfaces than the working areas, which will be lighter and brighter. The special attraction of this type of living will achieve a new level of interior architecture, similar to the interior architecture of ships, which strongly influenced interior arrangement on land. Technology will play a dominant role in all areas, and will present itself in many new ways. It will have to be presented

as more lively and friendlier, if it is to reflect the current requirements.

Now we turn once again to the psychological aspects, as shown in the diary of Cosmonaut Lebedev. The impact of heritage, family and life up until now plays an increasing role. Wife and child, youth and childhood, parents and homeland, all these appear in a new light, and have to be assimilated. The apparent difficulties experienced by the highly emotional Soviets were only suppressed by their heroic idealism, and not overcome. However, extensive psychological training allows the required emotional level to be attained, which increases the ability to experience everything new. This then prepares them for acceptance of new developments, and especially helps them to avoid homesickness. One can internalize psychological feelings so much, that the majority of them need not be carried along into space in order to maintain the integrity of the soul, overcome the fear of being left behind, and thus be prepared to experience the new situation.

In the course of the coming optimization process, models will have to be developed and tested. Space environmental designs of all types, incorporating light, ventilation and daylight orientation, just to name a few examples, will be developed, as well as models of psychological development, which in the most optimistic case will

lead to a new level of awareness of the modern, "zero gravity" man. This will then be of real value for mankind, and is more important than all other technological and economic advantages.

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